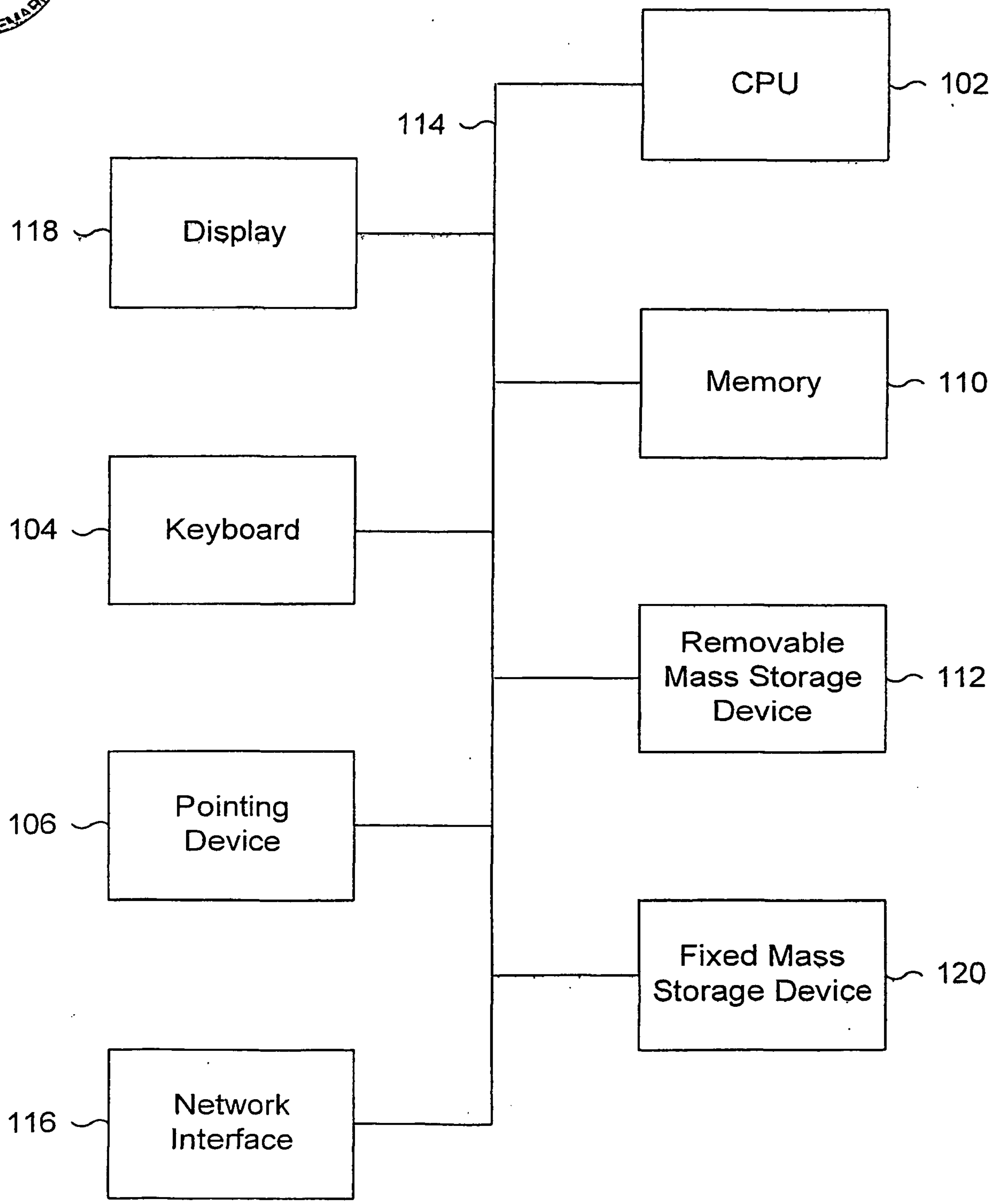

CPU
102
114
Display
118
Memory
110
Keyboard
104
Removable Mass Storage Device
112
Pointing Device
106
Fixed Mass Storage Device
120
Network Interface
116

Figure 1

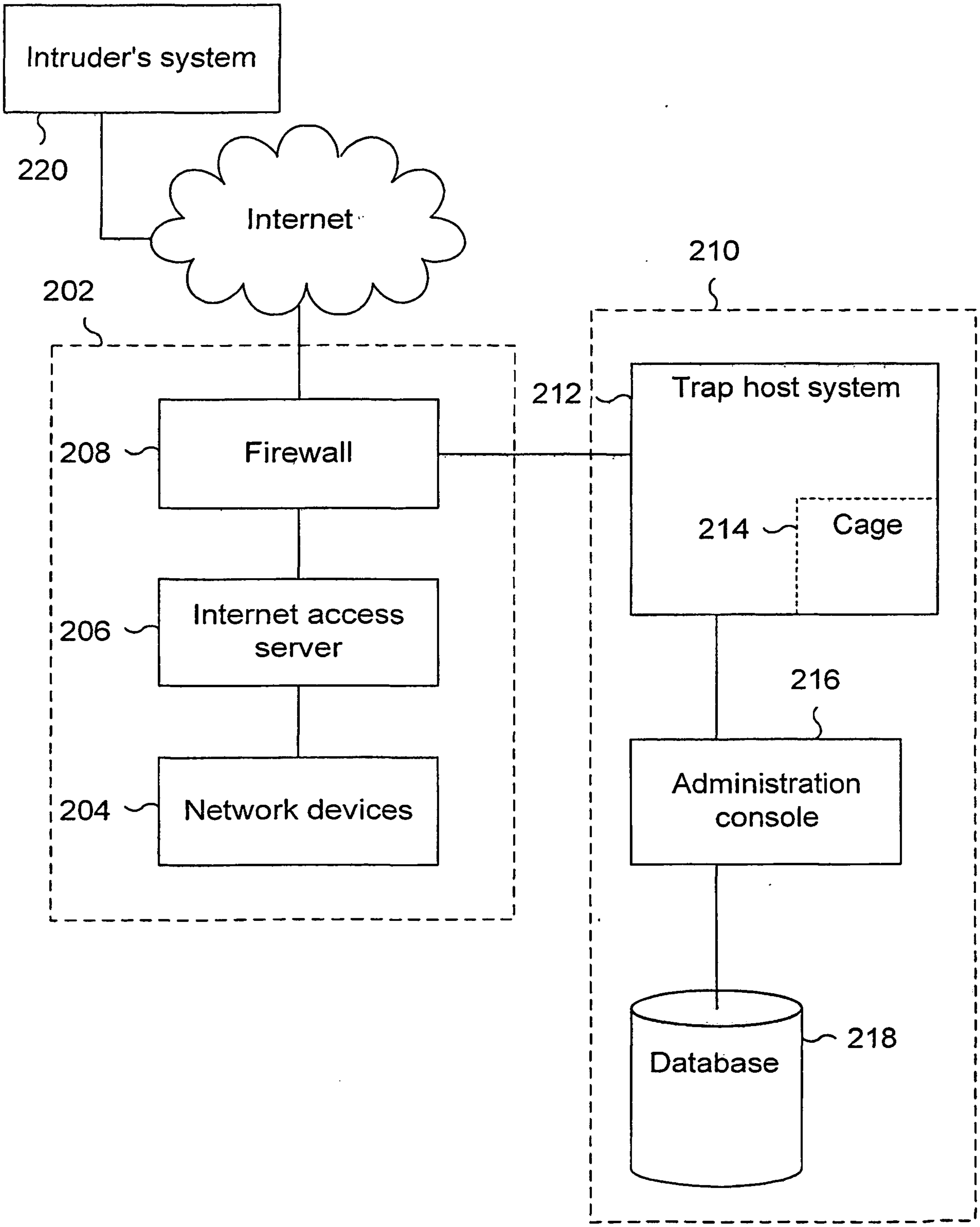

Intruder's system
220
Internet
202
210
212
Trap host system
208
Firewall
214
Cage
206
Internet access server
216
204
Network devices
Administration console
Database
218

Figure 2

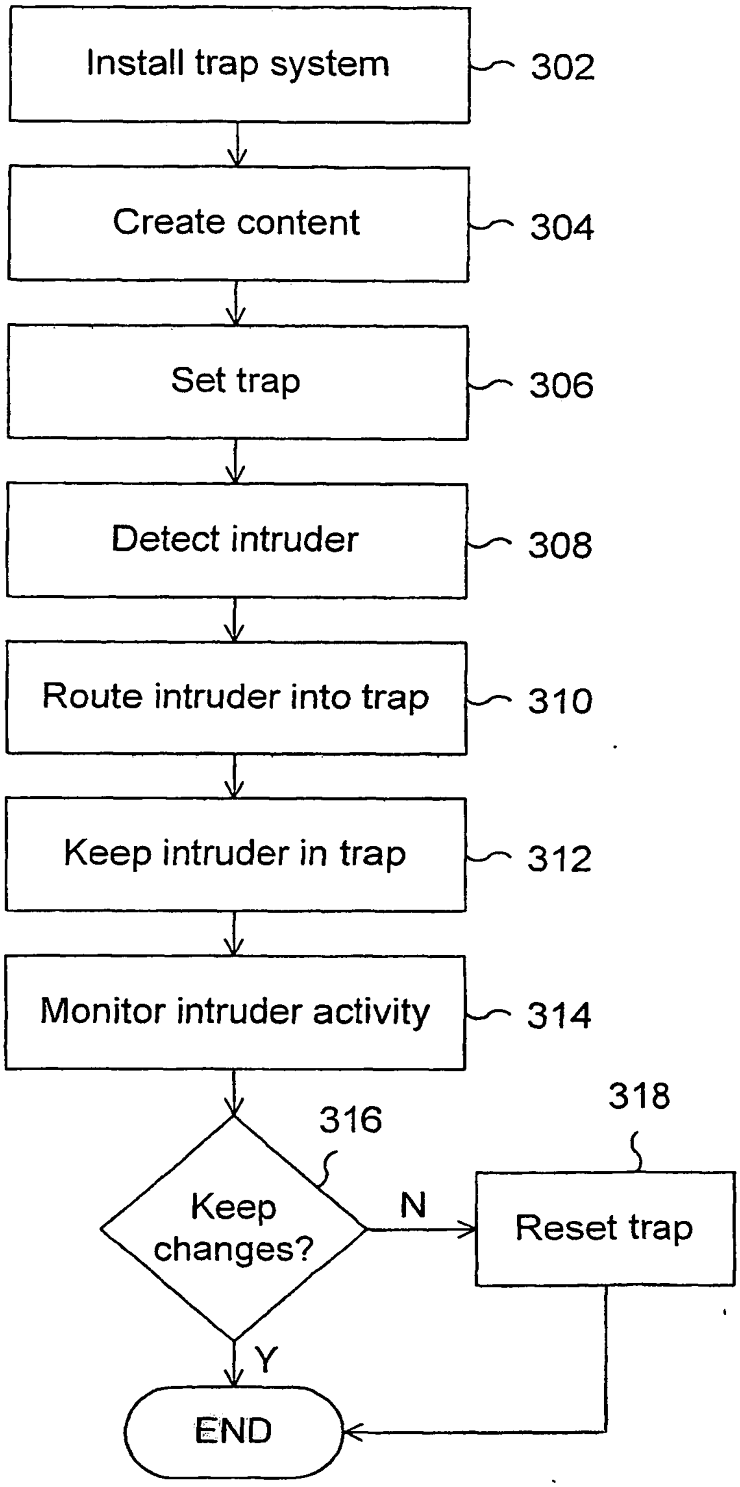

Install trap system
302
Create content
304
Set trap
306
Detect intruder
308
Route intruder into trap
310
Keep intruder in trap
312
Monitor intruder activity
314
316
318
Keep changes?
N
Reset trap
Y
END

Figure 3

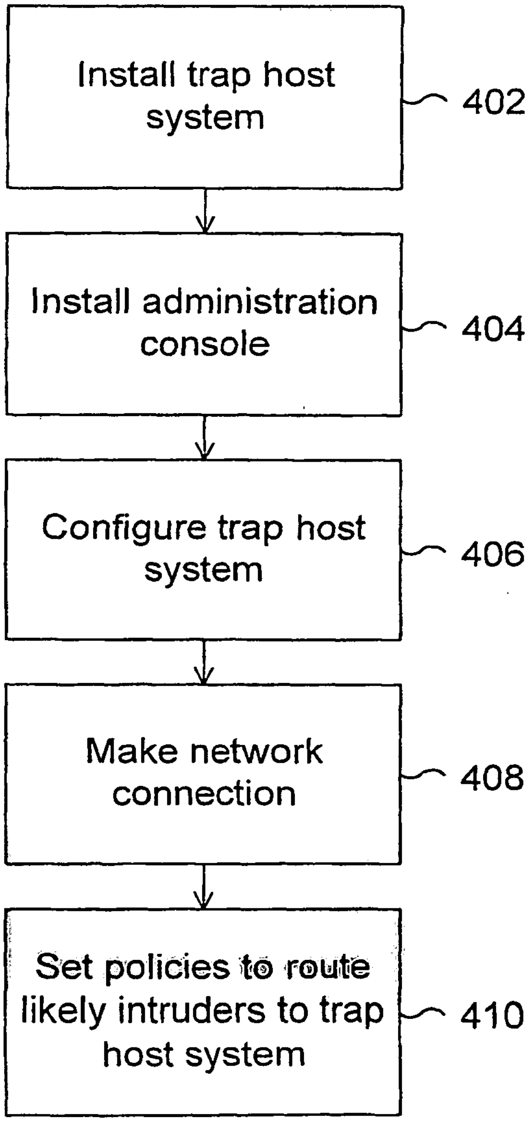

Install trap host system
402
Install administration console
404
Configure trap host system
406
Make network connection
408
Set policies to route likely intruders to trap host system
410

Figure 4

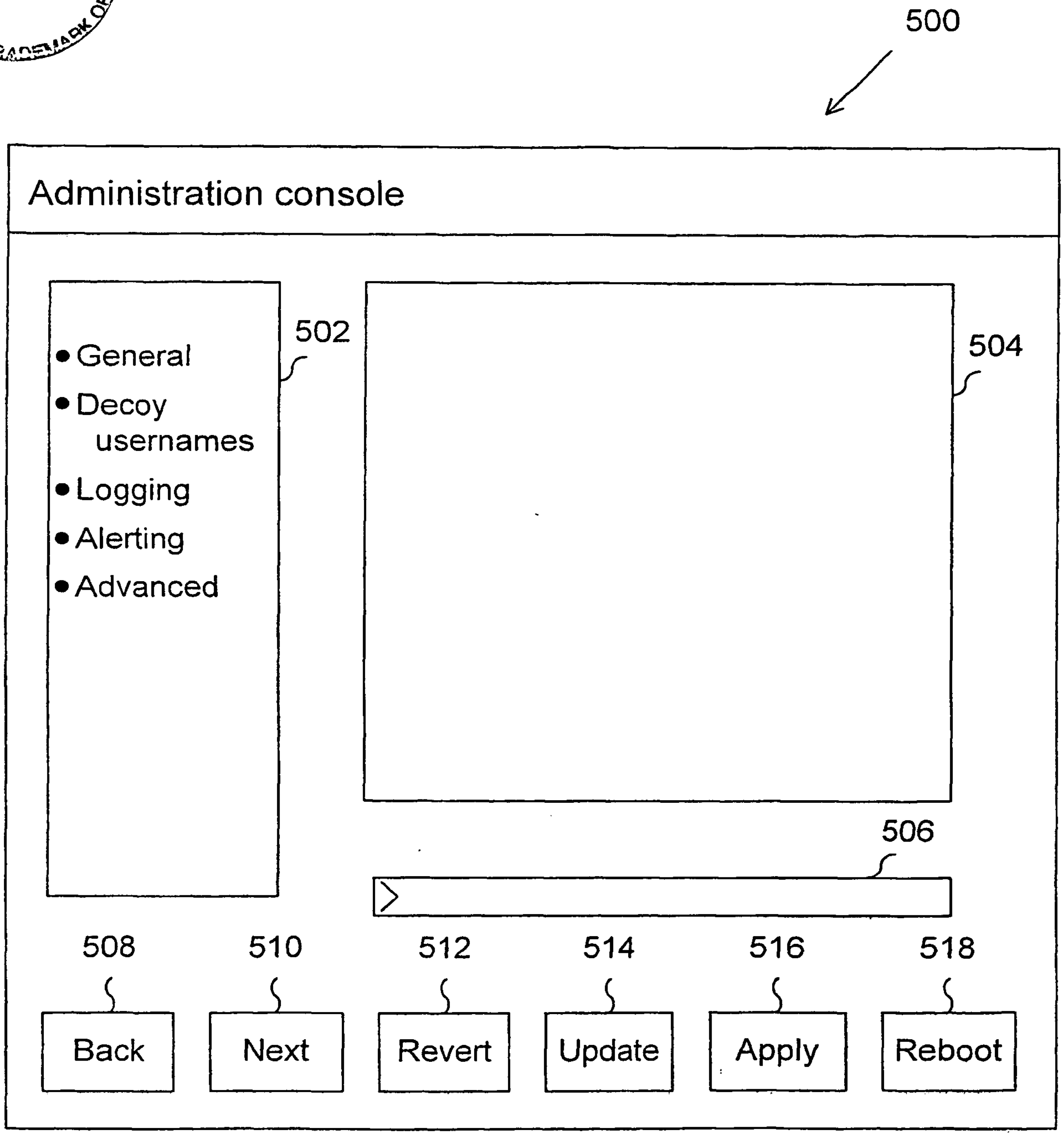

500
Administration console
502
General
Decoy usernames
Logging
Alerting
Advanced
504
506
508
510
512
514
516
518
Back
Next
Revert
Update
Apply
Reboot

Figure 5

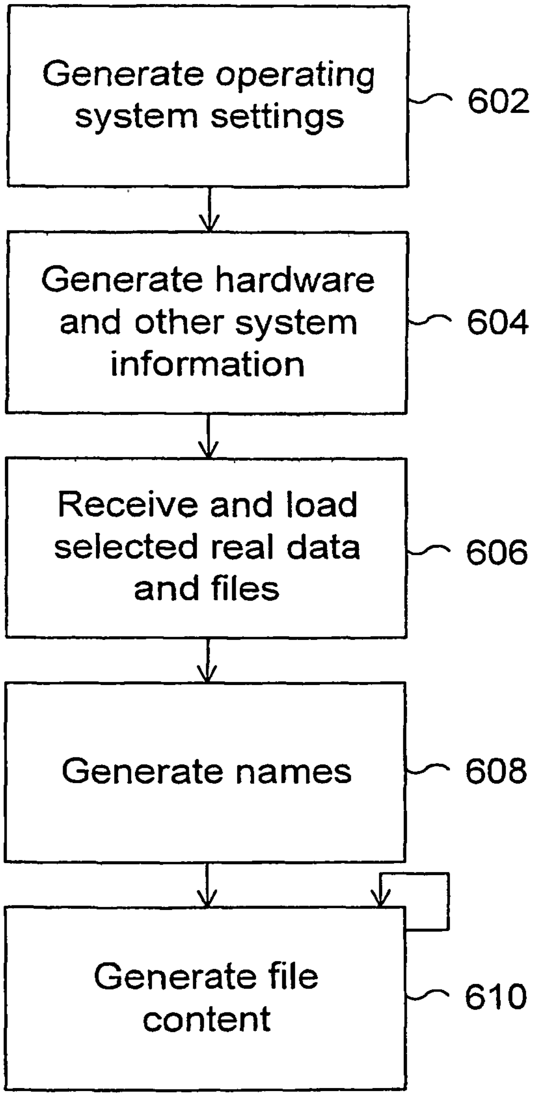

Generate operating system settings
602
Generate hardware and other system information
604
Receive and load selected real data and files
606
Generate names
608
Generate file content
610

Figure 6

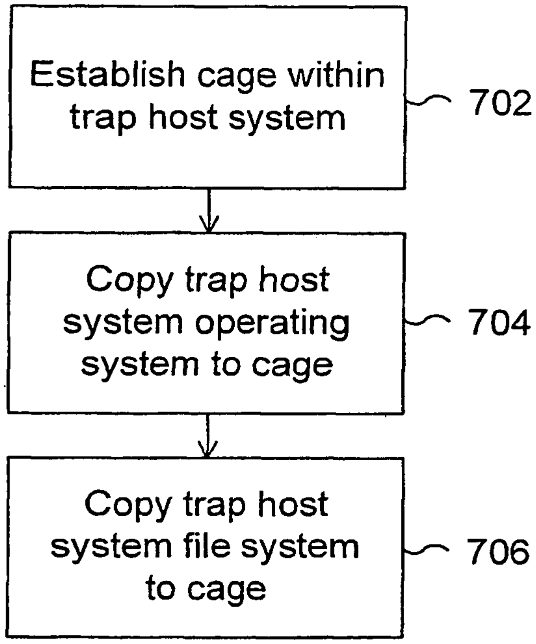
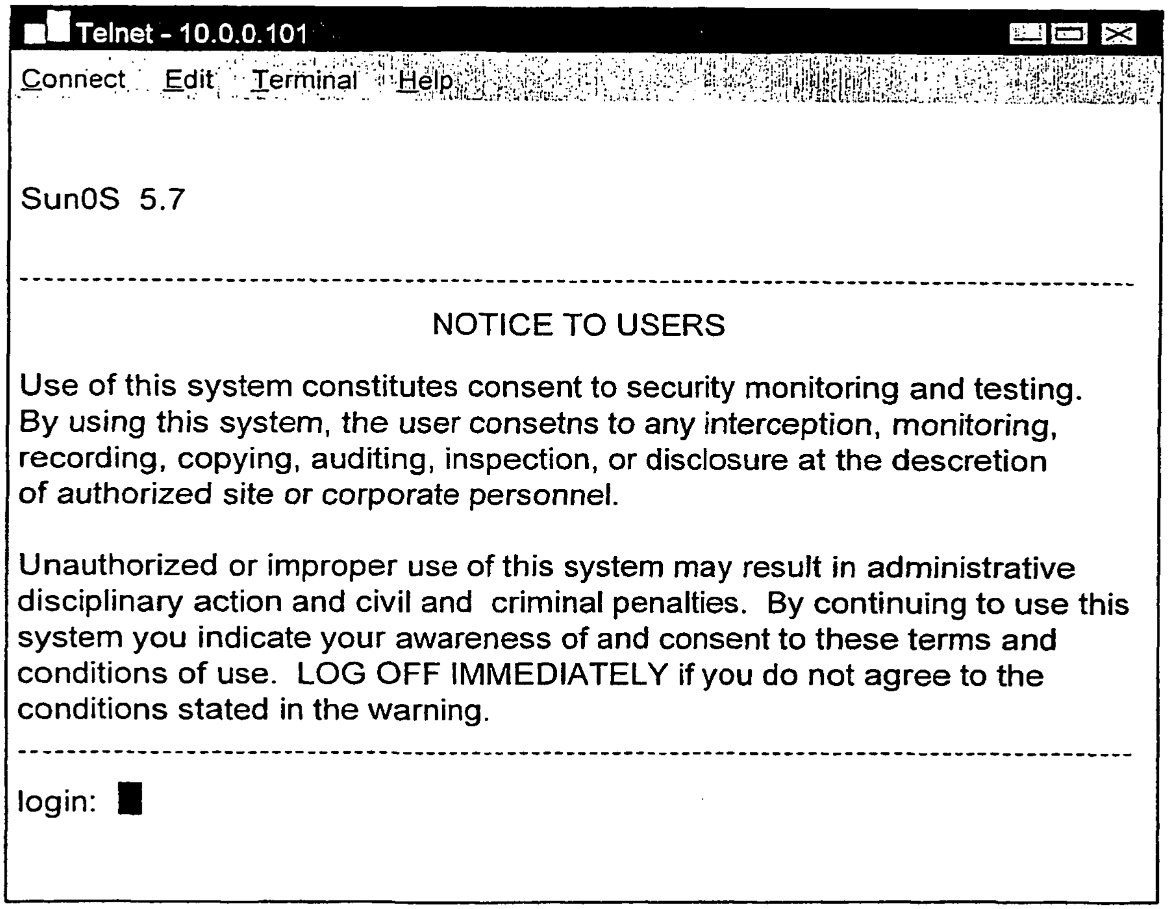

Establish cage within trap host system
702
Copy trap host system operating system to cage
704
Copy trap host system file system to cage
706

Figure 7



```
SunOS 5.7

-----------------------------------------------------------------------------------------
                                  NOTICE TO USERS

Use of this system constitutes consent to security monitoring and testing.
By using this system, the user consetns to any interception, monitoring,
recording, copying, auditing, inspection, or disclosure at the descretion
of authorized site or corporate personnel.

Unauthorized or improper use of this system may result in administrative
disciplinary action and civil and criminal penalties. By continuing to use this
system you indicate your awareness of and consent to these terms and
conditions of use. LOG OFF IMMEDIATELY if you do not agree to the
conditions stated in the warning.
-----------------------------------------------------------------------------------------
login: █
```

Figure 8

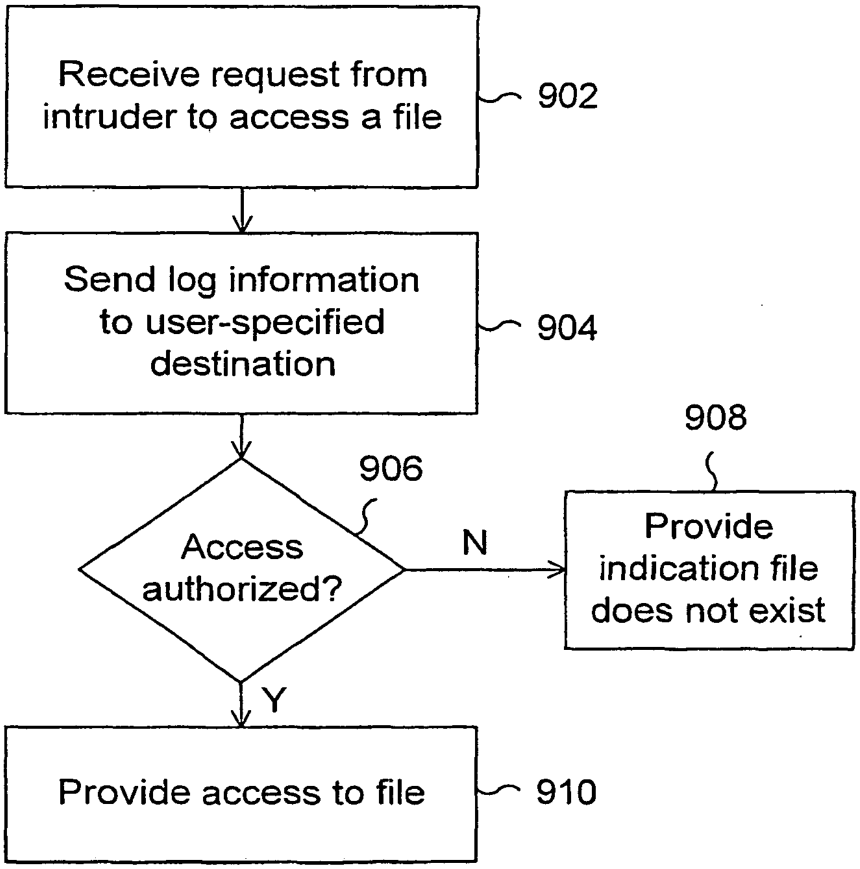

Receive request from intruder to access a file
902
Send log information to user-specified destination
904
Access authorized?
906
N
908
Provide indication file does not exist
Y
Provide access to file
910

Figure 9

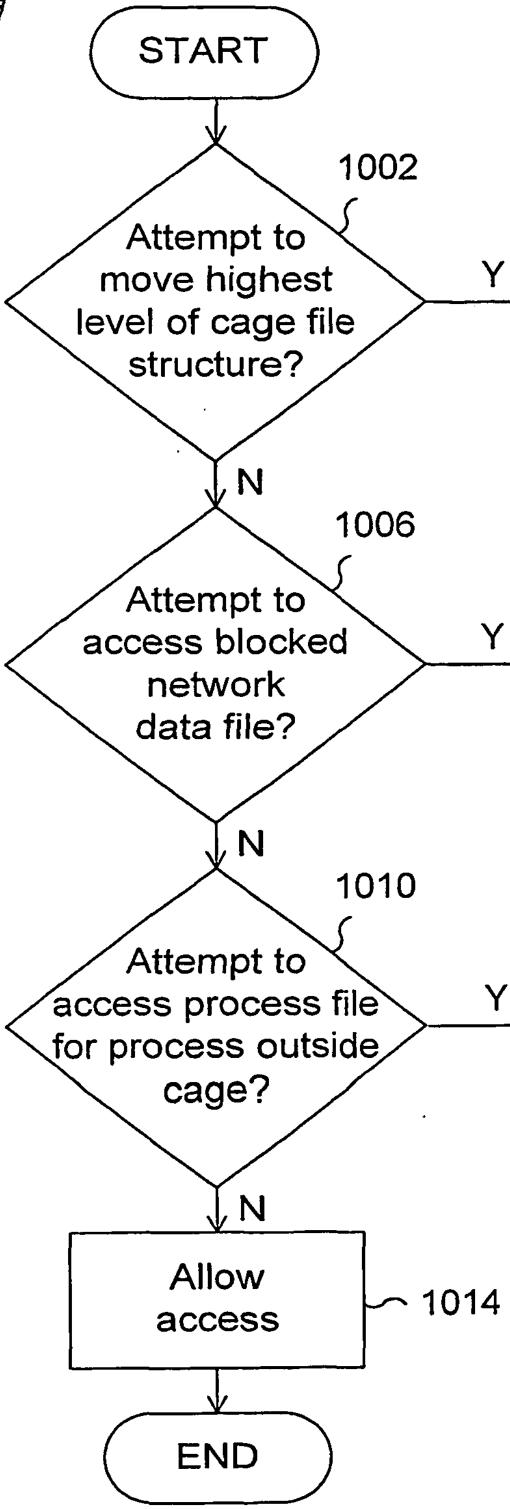

START
Attempt to move highest level of cage file structure?
1002
Y
1004
Deny access
N
Attempt to access blocked network data file?
1006
Y
1008
Deny access
N
Attempt to access process file for process outside cage?
1010
Y
1012
Deny access
N
Allow access
1014
END

Figure 10

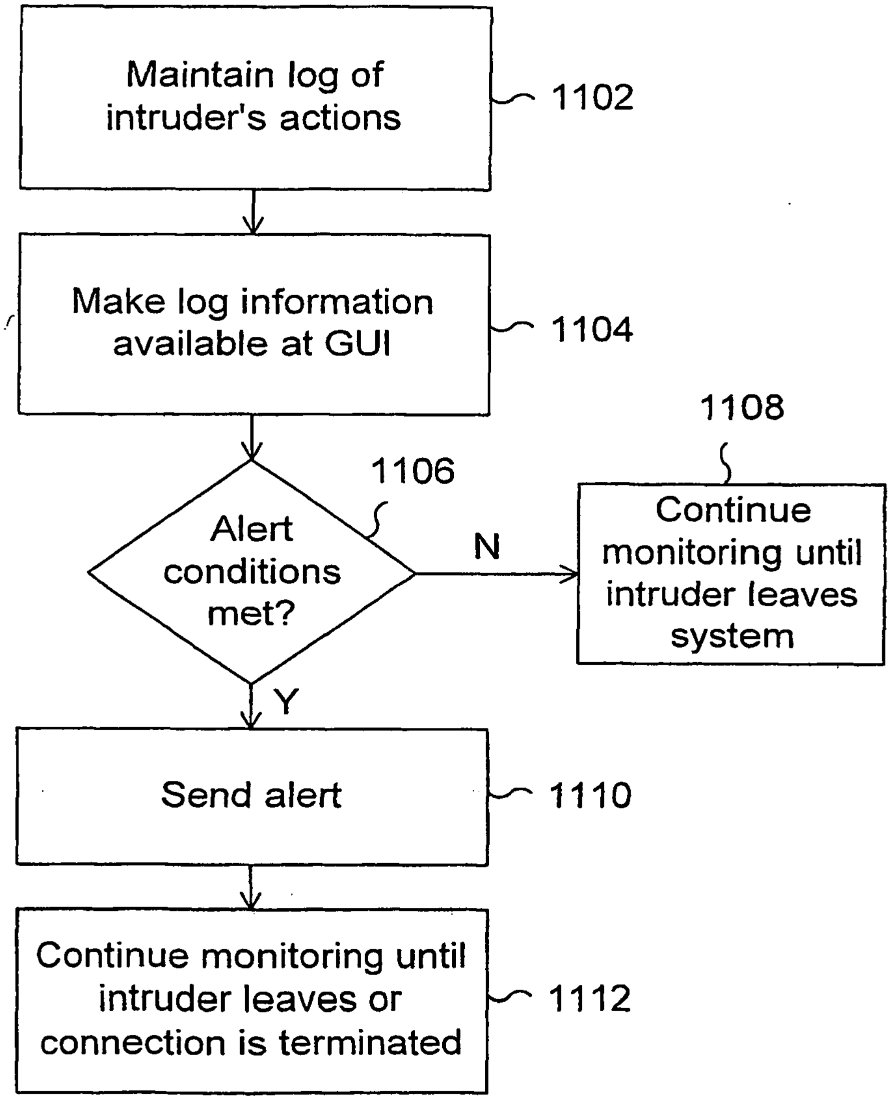

Maintain log of intruder's actions
1102
Make log information available at GUI
1104
1108
1106
Alert conditions met?
N
Continue monitoring until intruder leaves system
Y
Send alert
1110
Continue monitoring until intruder leaves or connection is terminated
1112

Figure11A

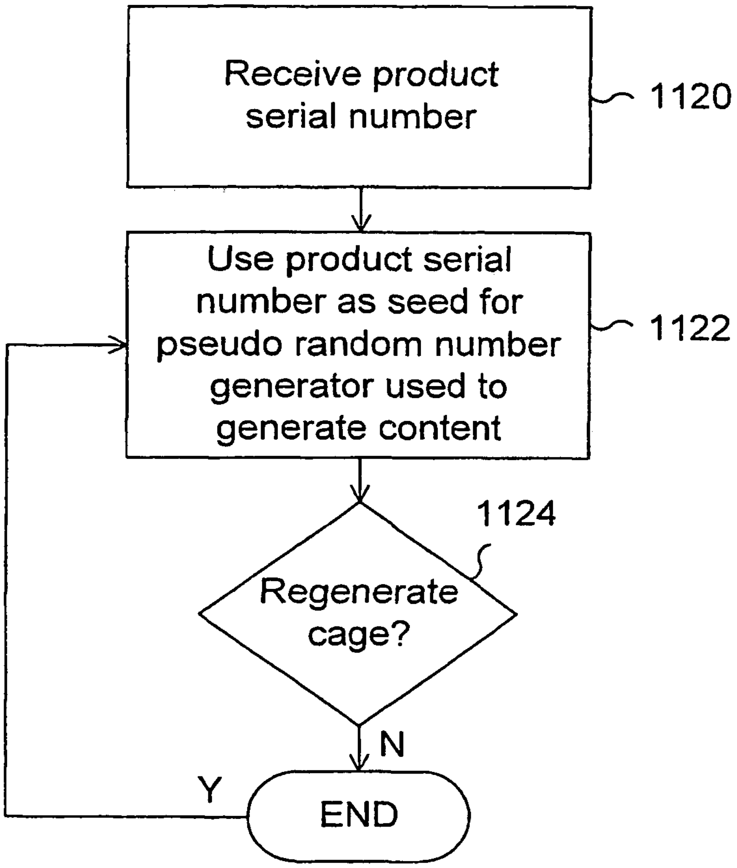

Receive product serial number
1120
Use product serial number as seed for pseudo random number generator used to generate content
1122
1124
Regenerate cage?
N
Y
END

Figure 11B

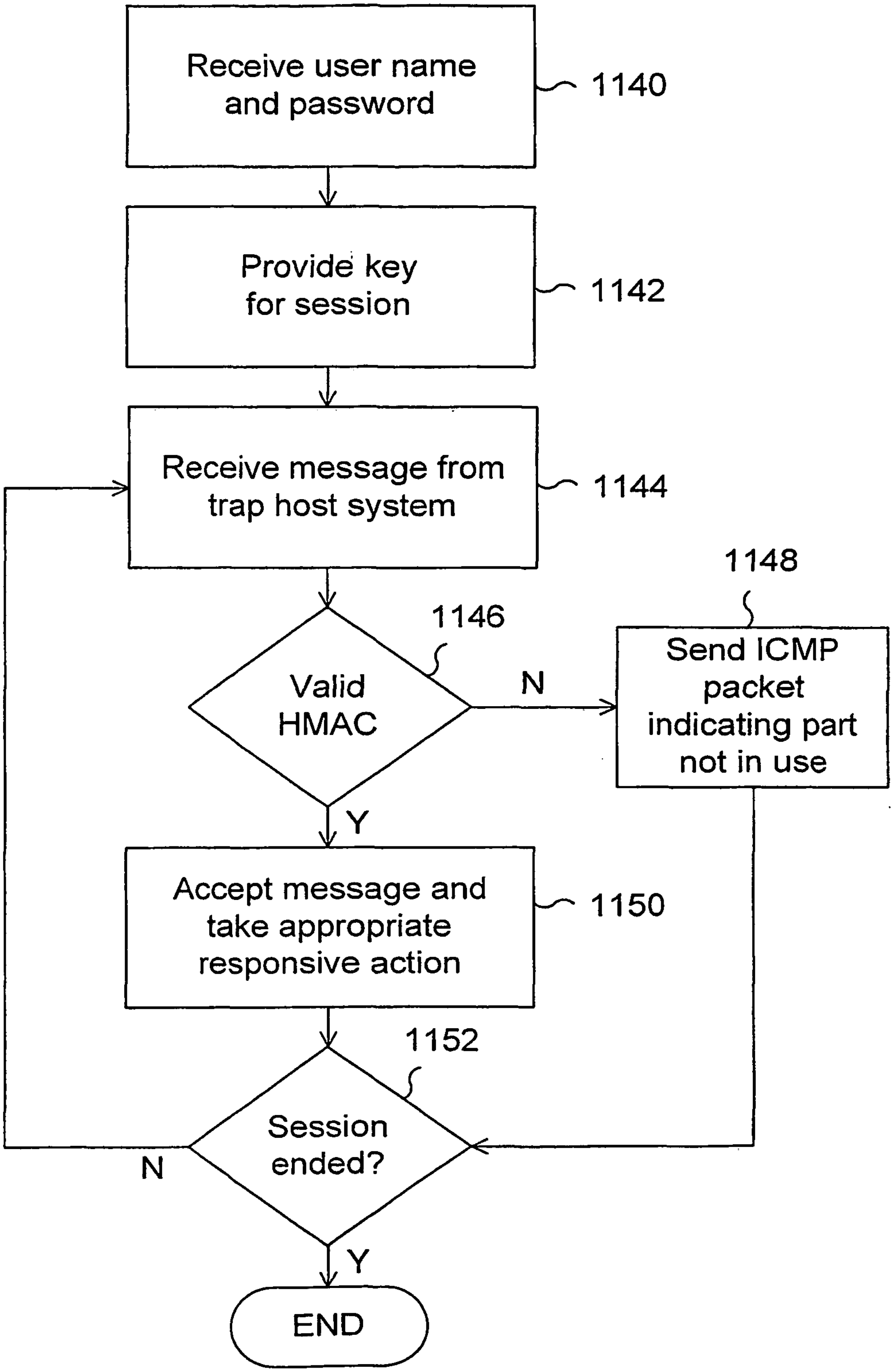

Receive user name and password
1140
Provide key for session
1142
Receive message from trap host system
1144
1146
Valid HMAC
N
1148
Send ICMP packet indicating part not in use
Y
Accept message and take appropriate responsive action
1150
1152
Session ended?
N
Y
END

Figure11C

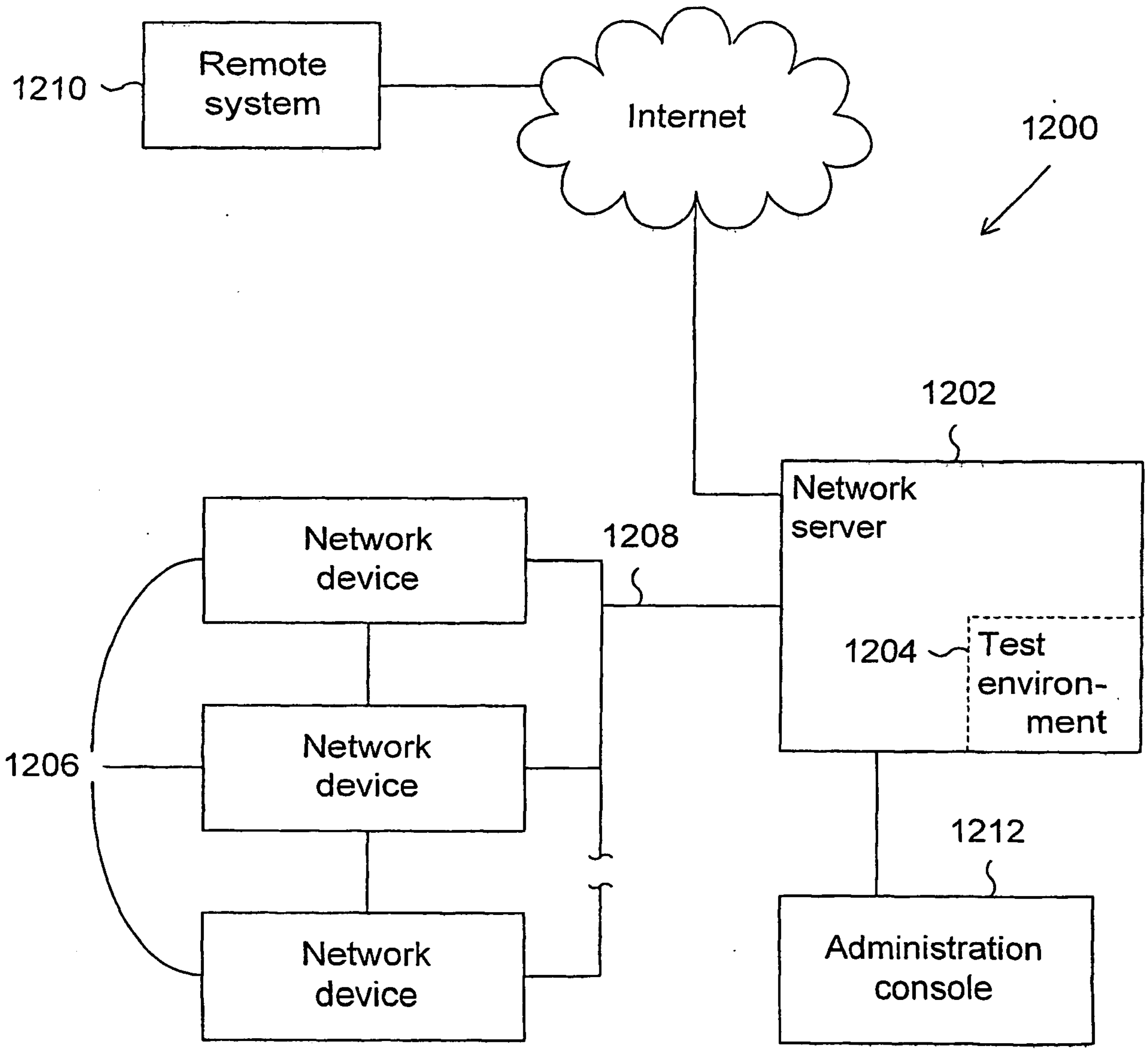

1210
Remote system
Internet
1200
1202
Network server
1204
Test environ-ment
1208
Network device
Network device
Network device
1206
1212
Administration console

Figure 12

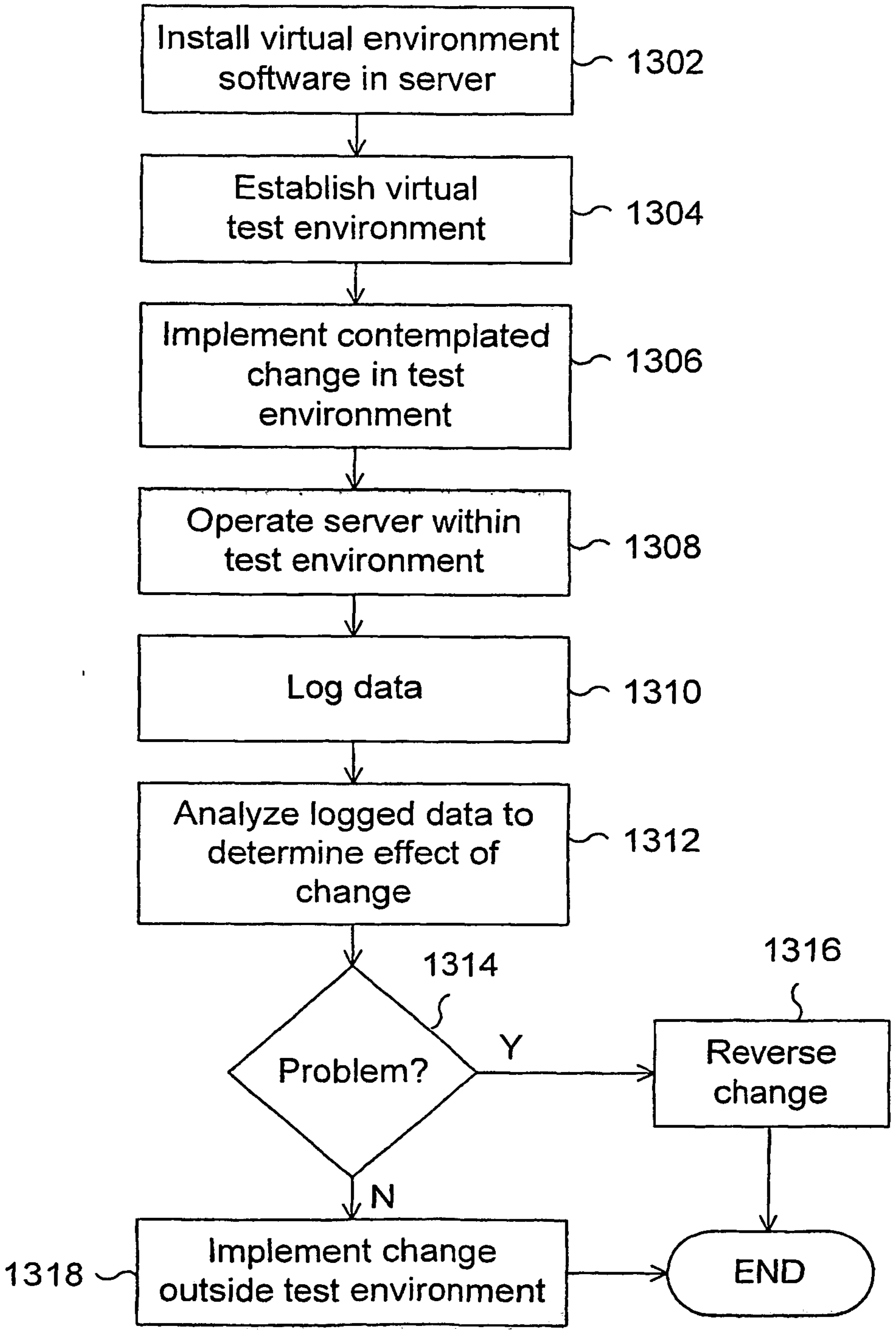

Install virtual environment software in server
1302
Establish virtual test environment
1304
Implement contemplated change in test environment
1306
Operate server within test environment
1308
Log data
1310
Analyze logged data to determine effect of change
1312
1314
Problem?
Y
N
1316
Reverse change
1318
Implement change outside test environment
END

Figure 13

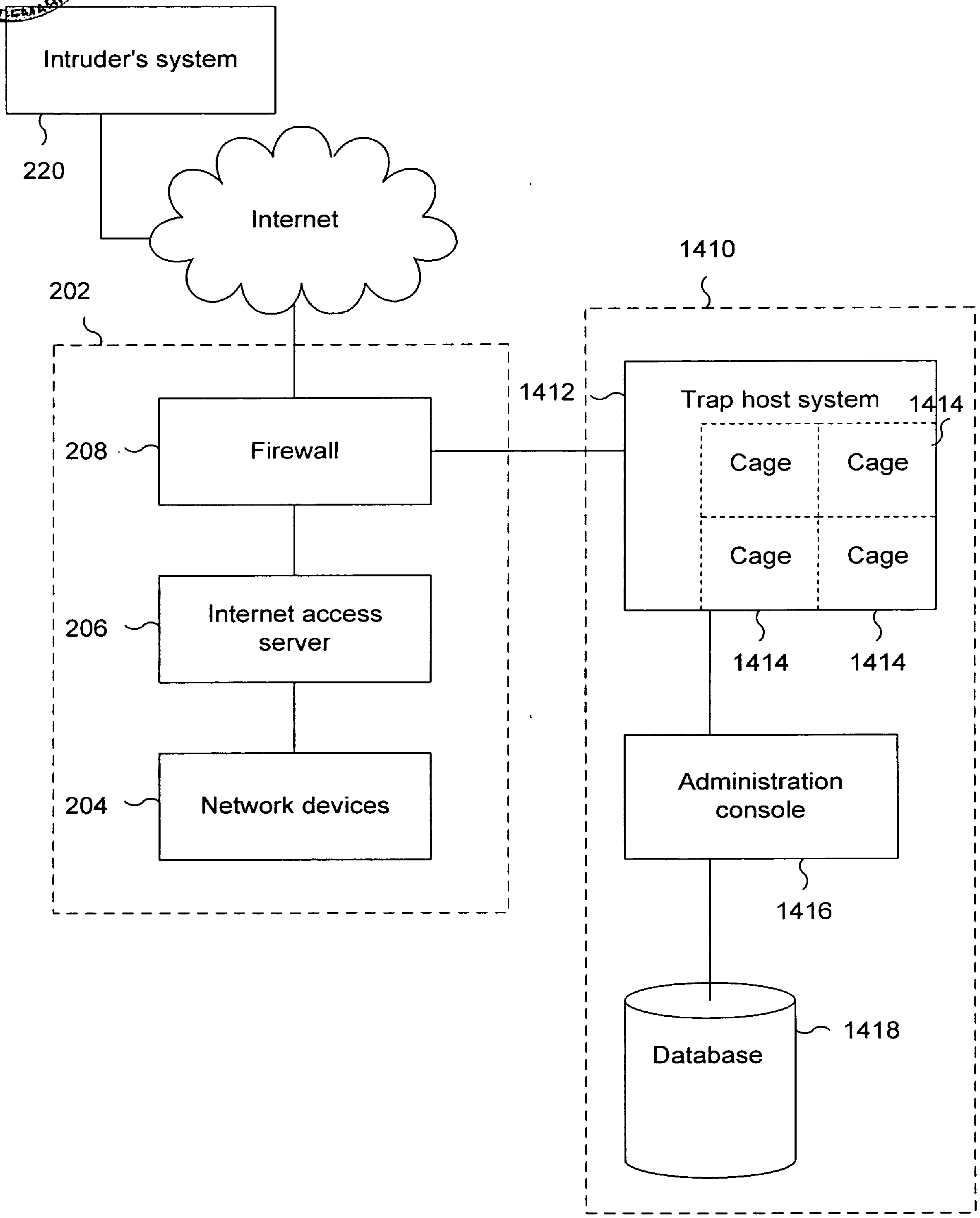

Intruder's system
220
Internet
202
1410
1412
Trap host system
1414
Firewall
208
Cage
Cage
Cage
Cage
206
Internet access server
1414
1414
204
Network devices
Administration console
1416
Database
1418

Figure 14

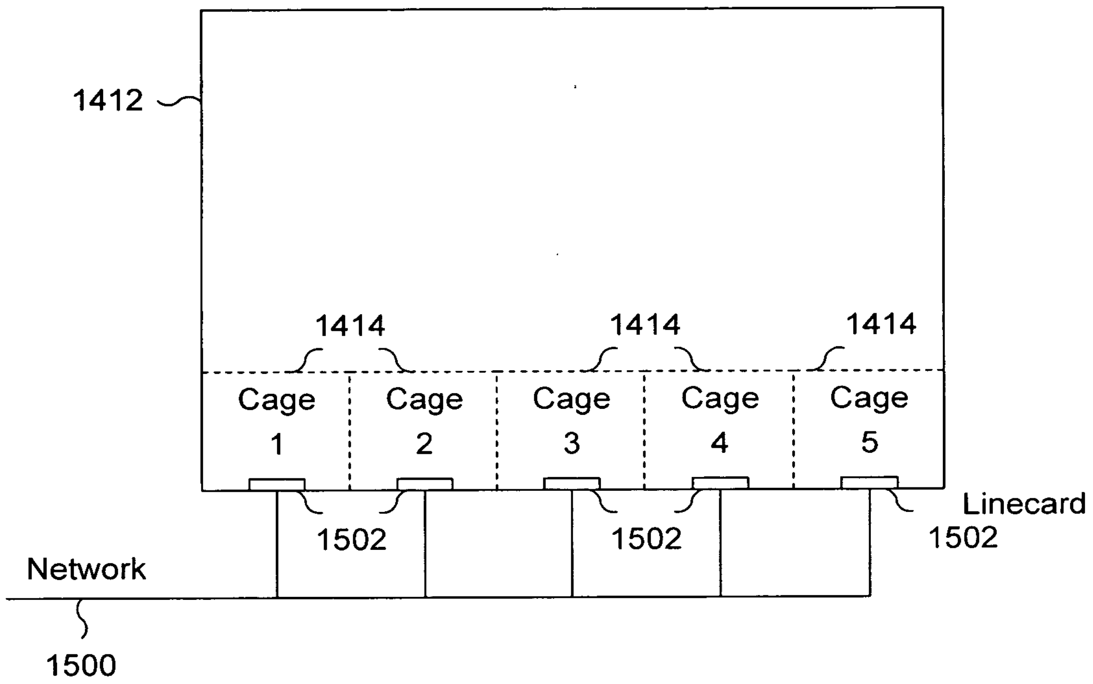

1412
1414
1414
1414
Cage 1
Cage 2
Cage 3
Cage 4
Cage 5
Linecard
1502
1502
1502
Network
1500

Figure 15

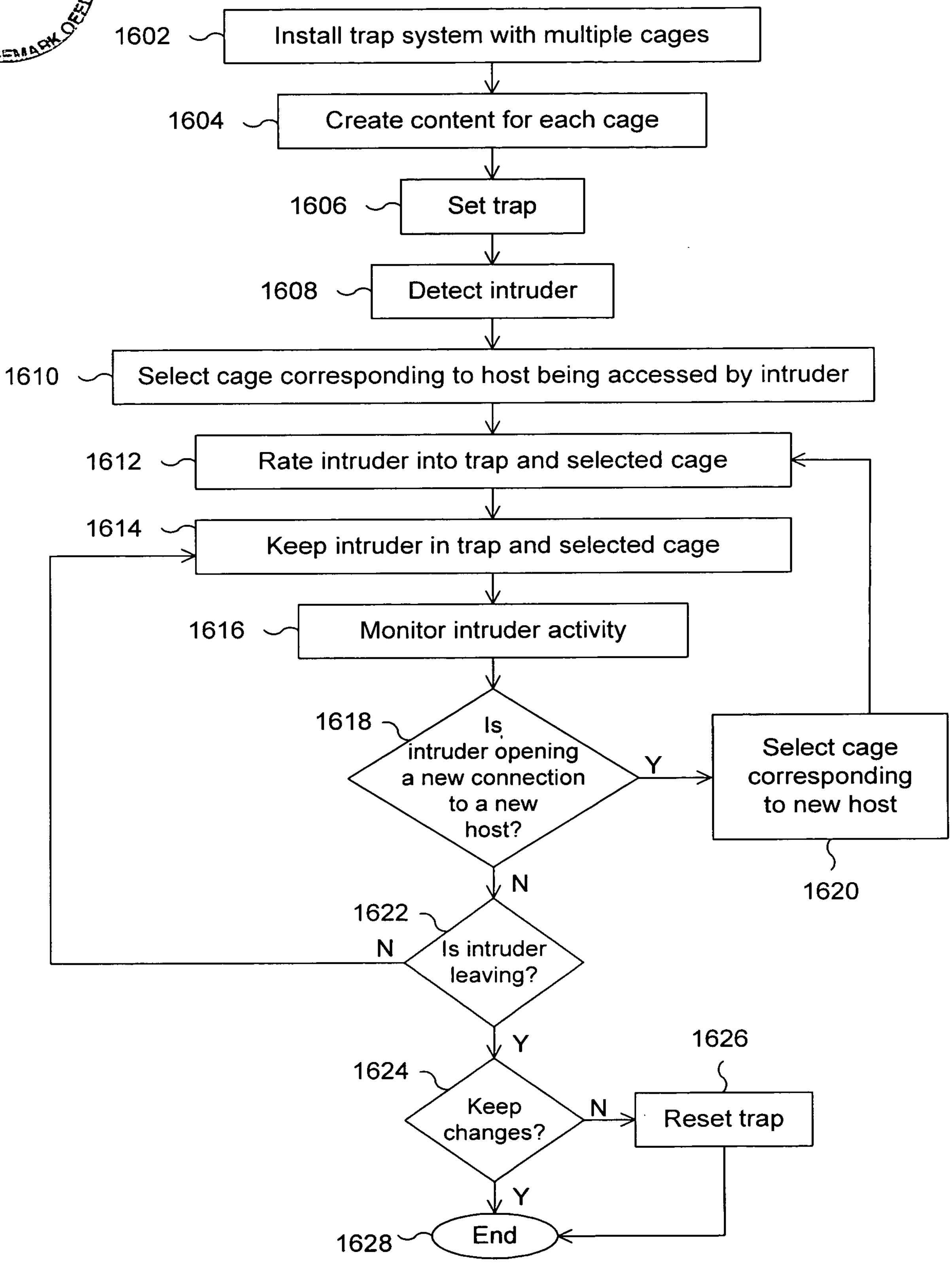

1602
Install trap system with multiple cages
1604
Create content for each cage
1606
Set trap
1608
Detect intruder
1610
Select cage corresponding to host being accessed by intruder
1612
Rate intruder into trap and selected cage
1614
Keep intruder in trap and selected cage
1616
Monitor intruder activity
1618
Is intruder opening a new connection to a new host?
Y
Select cage corresponding to new host
1620
N
1622
Is intruder leaving?
N
Y
1624
Keep changes?
N
1626
Reset trap
Y
1628
End

Figure 16

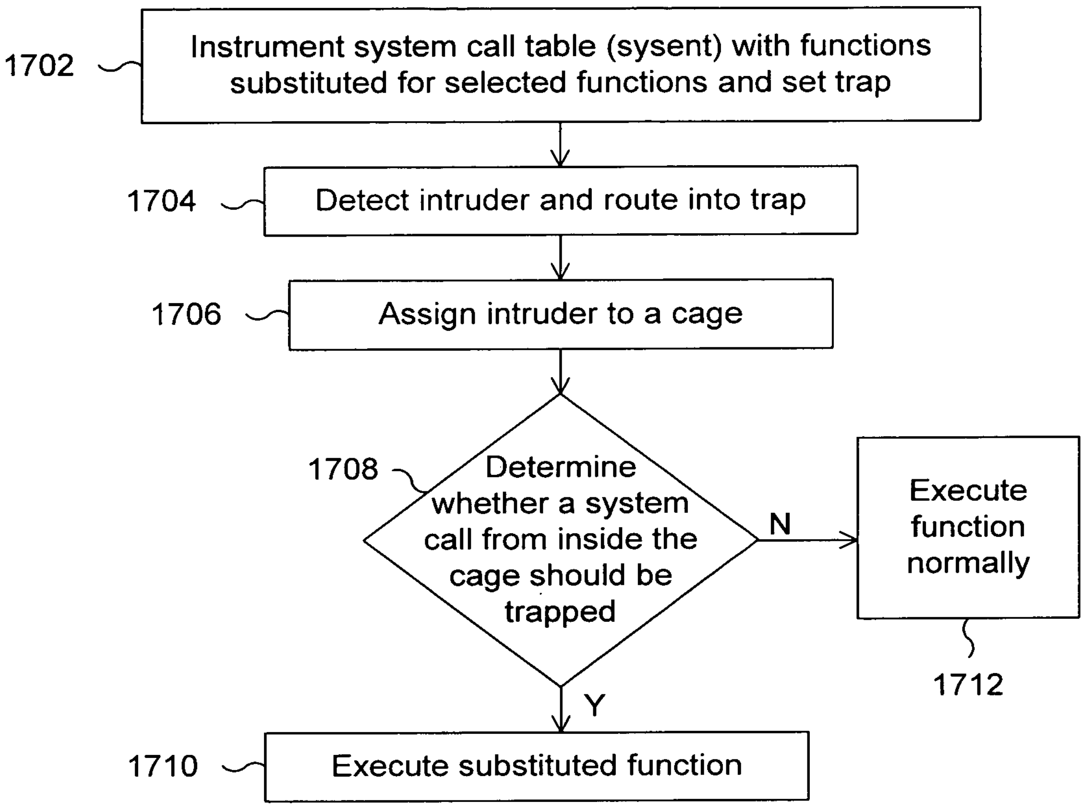

1702
Instrument system call table (sysent) with functions substituted for selected functions and set trap
1704
Detect intruder and route into trap
1706
Assign intruder to a cage
1708
Determine whether a system call from inside the cage should be trapped
N
Execute function normally
1712
Y
1710
Execute substituted function

Figure 17

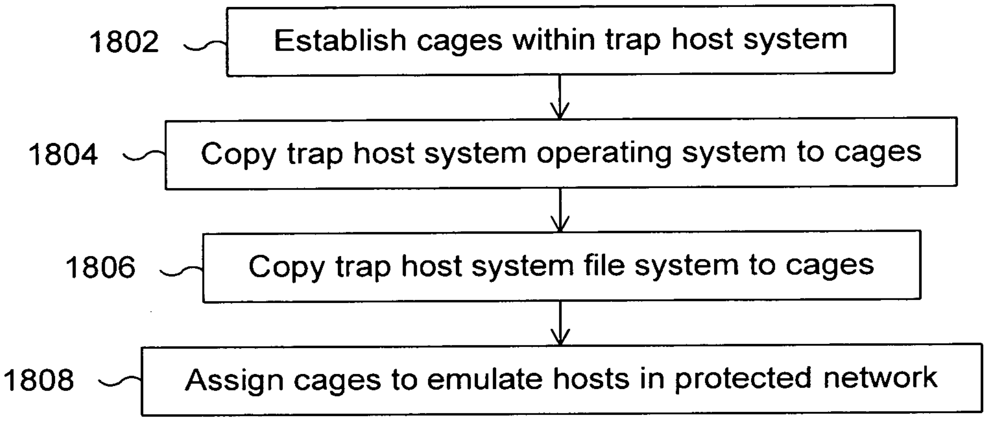

1802
Establish cages within trap host system
1804
Copy trap host system operating system to cages
1806
Copy trap host system file system to cages
1808
Assign cages to emulate hosts in protected network

Figure 18

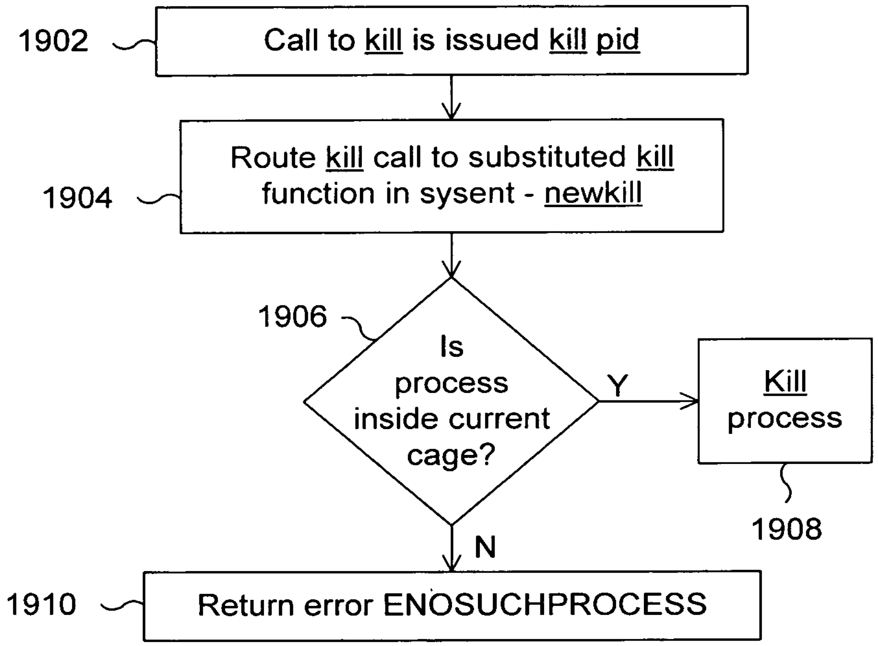

1902
Call to kill is issued kill pid
1904
Route kill call to substituted kill function in sysent - newkill
1906
Is process inside current cage?
Y
Kill process
1908
N
1910
Return error ENOSUCHPROCESS

Figure 19

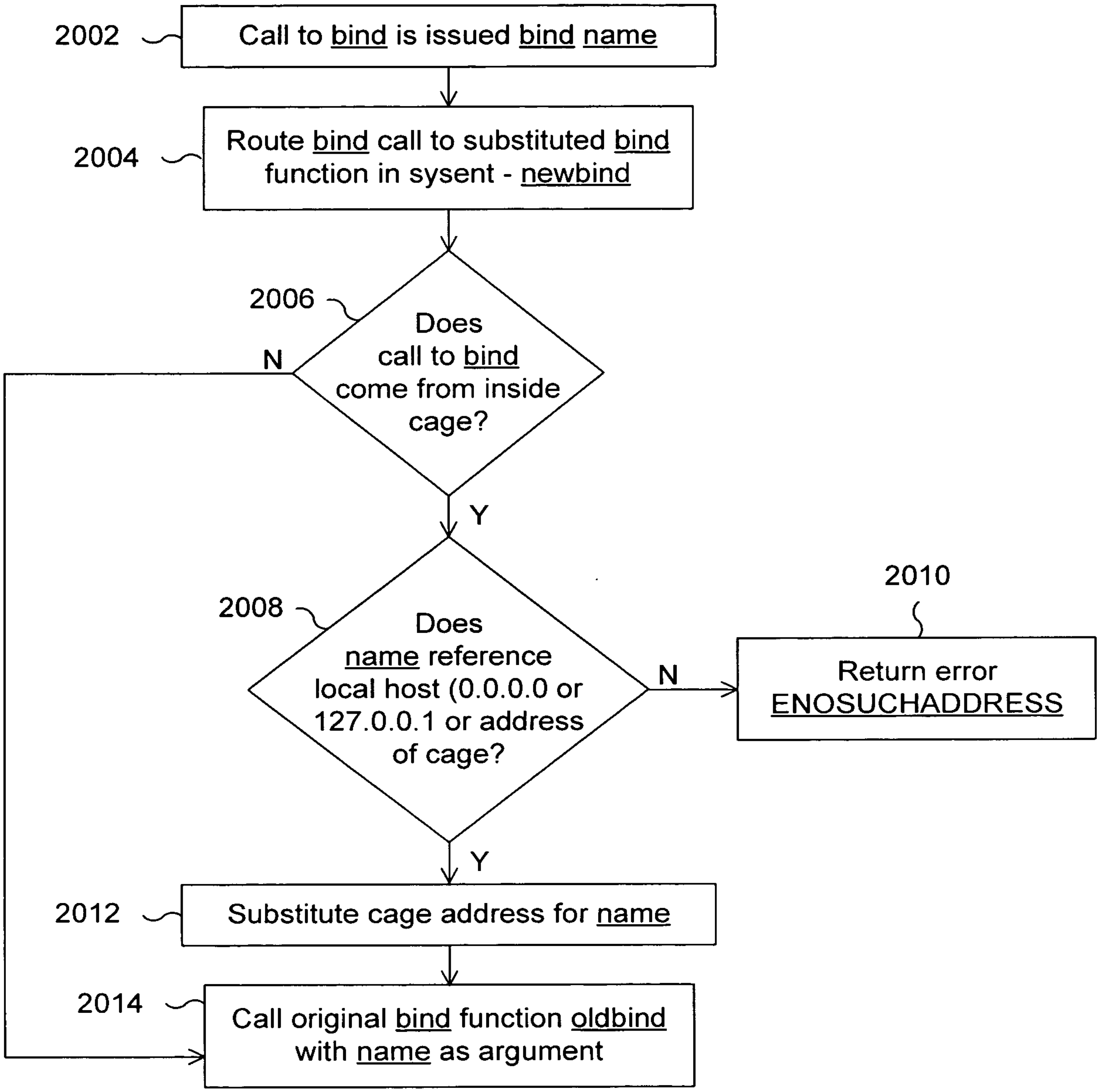

2002
Call to bind is issued bind name
2004
Route bind call to substituted bind function in sysent - newbind
2006
Does call to bind come from inside cage?
N
Y
2008
Does name reference local host (0.0.0.0 or 127.0.0.1 or address of cage?
N
2010
Return error ENOSUCHADDRESS
Y
2012
Substitute cage address for name
2014
Call original bind function oldbind with name as argument

Figure 20

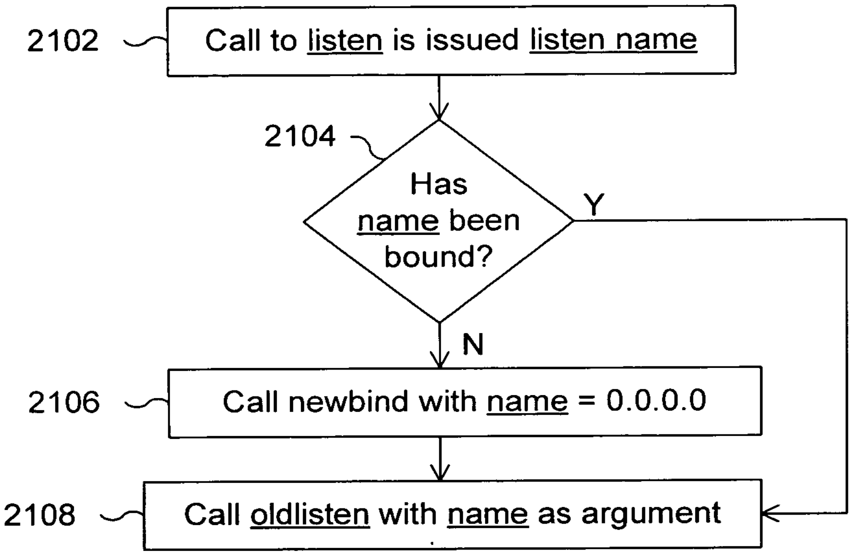

2102
Call to listen is issued listen name
2104
Has name been bound?
Y
N
2106
Call newbind with name = 0.0.0.0
2108
Call oldlisten with name as argument

Figure 21

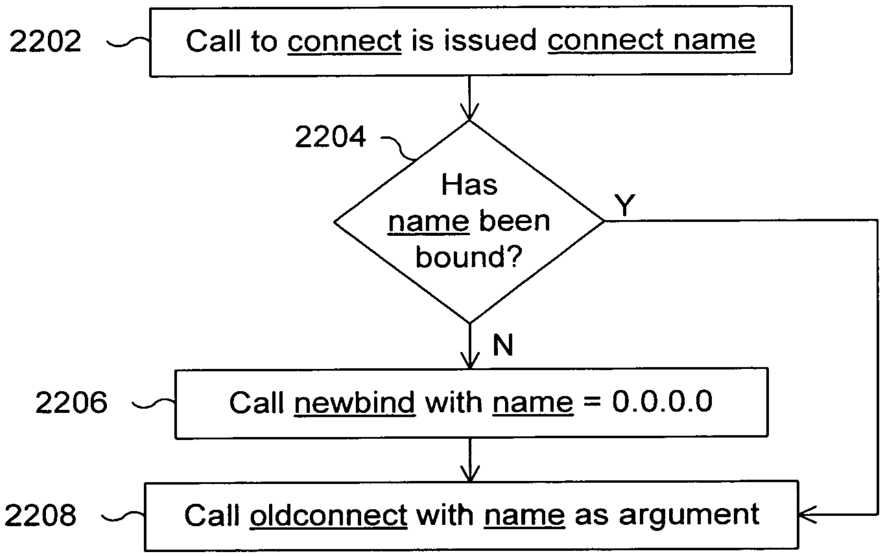

2202
Call to connect is issued connect name
2204
Has name been bound?
Y
N
2206
Call newbind with name = 0.0.0.0
2208
Call oldconnect with name as argument

Figure 22

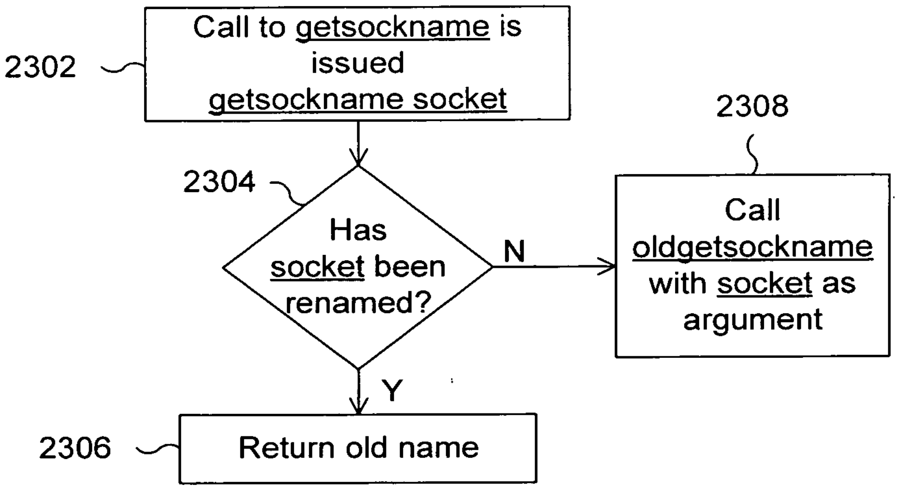

2302
Call to getsockname is issued
getsockname socket
2304
Has socket been renamed?
N
Y
2308
Call oldgetsockname with socket as argument
2306
Return old name

Figure 23

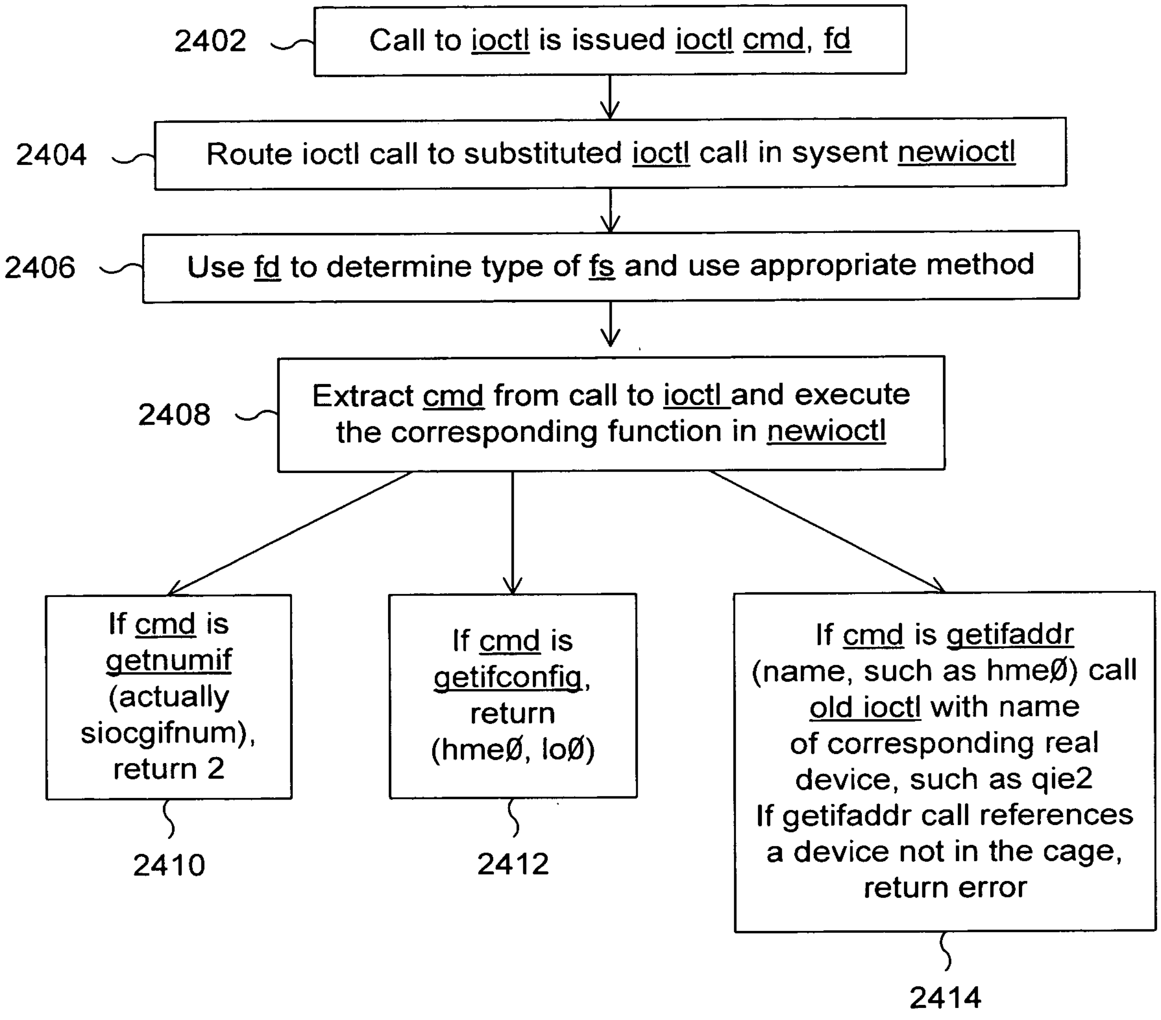

2402
Call to ioctl is issued ioctl cmd, fd
2404
Route ioctl call to substituted ioctl call in sysent newioctl
2406
Use fd to determine type of fs and use appropriate method
2408
Extract cmd from call to ioctl and execute the corresponding function in newioctl
If cmd is getnumif (actually siocgifnum), return 2
2410
If cmd is getifconfig, return (hmeØ, loØ)
2412
If cmd is getifaddr (name, such as hmeØ) call old ioctl with name of corresponding real device, such as qie2 If getifaddr call references a device not in the cage, return error
2414

Figure 24

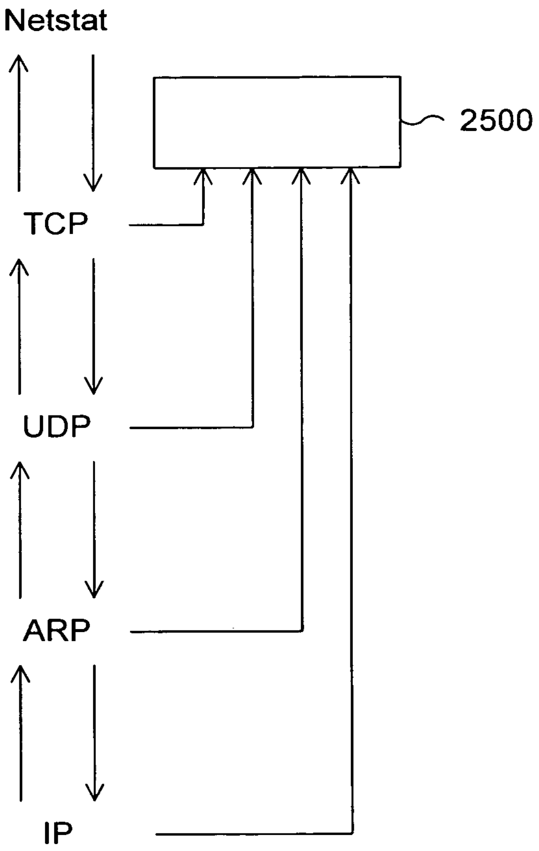


Figure 25

```
<doc>
<regexp-query>
      <name>Possible SGID Exploit</name>
      <properties>
            <priority>10</priority>
      </properties>
      <pattern>
            <next>
            <line>.*exec args=.*pid=\((\d+)\); ppid=\(\d+\); uid=\(\d+\); euid=
\(\d+\); gid=\([1-9]\d*\); egid=\(0\).*</line>
            </next>
            <next>
            <line>.*args=\([\-\w\\\/ ]+\); pid=\(\d+\); ppid=\(%1%\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*args=\(([\-\w\\\/ ]+)\).*ppid=\(%1%\).*</line>
                  <action>
                        <highlight/>
                        <delete/>
                        <varop var="agg">%1%</varop>

                  </action>
            </actionpair>
      </procmatch>
      <annotation>
            <text>Possible SGID Exploit: %agg%</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 26

```
<doc>
      <regexp-query>
      <name>Possible SUID Exploit</name>
      <properties>
            <priority>10< /priority>
      </properties>
      <pattern>
            <next>
            <line>.*exec args=.*pid=\((\d+)\); ppid=\(\d+\); uid=\([1-9]\d*\);
euid=\(0\).*</line>
            </next>
            <next>
            <line>.*args=\(.+\); pid=\(\d+\); ppid=\(%1%\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*args=\(.+)\); pid=\(\d+\); ppid=\(%1%\).*</line>
                  <action>
                        <highlight/>
                        <delete/>
                        <varop var="agg">%1%</varop>
                  </action>
      </procmatch>
      <annotation>
            <text>Possible SUID Exploit: %agg%</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 27

```
<doc>
<regexp-query>
      <name>All Processes</name>
      <properties>
            <priority>10</priority>
      </properties>
      <pattern>
            <next>
            <line>.*proclog.*args=\(([\-\.\w\\\/ ]+)\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*args=\(([\-\.\w\\\/ ]+)\).*</line>
                  <action>
                        <highlight/>
                        <delete/>
                        <varop var="agg">%1%</varop>
                  </action>
            </actionpair>
      </procmatch>
      <annotation>
            <text>Process started: %agg%</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 28

```
<doc>
<regexp-query>
      <name>Find Processes...</name>
      <properties>
            <priority>10</priority>
      </properties>
      <args>
            <args>.+</args>
            <pid>\d+</pid>
            <ppid>\d+</ppid>
            <uid>\d+</uid>
            <euid>\d+</euid>
            <gid>\d+</gid>
            <egid>\d+</egid>
      </args>
      <pattern>
            <next>
            <line>.*args=\(%args%\); pid=\(%pid%\); ppid=\(%ppid%\);
uid=\(%uid%\); euid=\(%euid%\); gid=\(%gid%\); egid=\(%egid%\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*args=\((.+)\); pid.*</line>
                  <action>
                        <highlight/>
                        <delete/>
                        <varop var="agg">%1%</varop>
                  </action>
            </actionpair>
      </procmatch>
      <annotation>
            <text>Process started: %agg%</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 29

```
<doc>
<regexp-query>
      <name>All Shell-spawned Processes</name>
      <properties>
            <priority>10</priority>
      </properties>
      <pattern>
            <next>
            <line>.*exec args=\(-sh\); pid=\((\d+)\).*</line>
            </next>
            <next>
            <line>.*args=\(([\-\w\\\/ ]+)\).*ppid=\(%1%\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*args=\(([\-\w\\\/ ]+)\).*ppid=\(%1%\).*</line>
                  <action>
                        <highlight/>
                        <varop var="agg">%1%</varop>
                  </action>
            </actionpair>
      </procmatch>
      <annotation>
            <text>Executed from a shell: %agg%</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 30

```
<doc>
<regexp-query>
      <name>Incoming Connections</name>
      <properties>
            <priority>10</priority>
      </properties>
      <pattern>
            <next>
            <line>.*incoming connection from=\(.+\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*incoming connection from=\((.+):(.+)\)
to=\((.+):(.+)\).*</line>
                  <action>
                        <highlight/>
                        <delete/>
                        <varop var= "fromip">%1%</varop>
                        <varop var= "fromport">%2%</varop>
                        <varop var= "toip">%3%</varop>
                        <varop var= "toport">%4%</varop>
                  </action>
            </actionpair>
      </procmatch>
      <annotation>
            <text>Incoming Connection From IP: %fromip% (on port: %fromport%) To
IP: %toip% (on port: %toport%)</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 31

```
<doc>
<regexp-query>
      <name>Keystrokes Entered</name>
      <properties>
            <priority>10</priority>
      </properties>
      <pattern>
            <next>
            <line>.*read stream data, id=\((\d+)\) data=\(.+\).*</line>
            </next>
            <next fromprev="1">
            <line>.*read stream data, id=\(%1%\) data=\(.*\\0[ad4].*\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*read stream data,  id=\(%1%\) data=\((.+)\).*</line>
                  <action>
                        <highlight/>
                        <delete/>
                        <varop var="agg">%1%</varop>
                  </action>
            </actionpair>
      </procmatch>
      <annotation>
            <text>Keystrokes Entered: %agg%</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 32

```
<doc>
<regexp-query>
      <name>Screen Output</name>
      <properties>
            <priority>10</priority>
      </properties>
      <pattern>
            <next>
            <line>.*write stream data, id=\((\d+)\) data=\(.+\).*</line>
            </next>
            <next fromprev="1">
            <line>.*write stream data, id=\(%1%\)
data=\(.*\\0[ad46].*\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*write stream data, id=\(%1%\) data=\((.+)\).*</line>
                  <action>
                        <highlight/>
                        <delete/>
                        <varop var="agg">%1%</varop>
                  </action>
            </actionpair>
      </procmatch>
      <annotation>
            <text>Output to screen: %agg%</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 33

```
<doc>
<regexp-query>
      <name>Find Monitored</name>
      <properties>
            <priority>10</priority>
      </properties>
      <args>
            <file_name>.+</file_name>
            <pid>\d+</pid>
      </args>
      <pattern>
            <next>
            <line>.*monitored file opened name=\(%file_name%\)
pid=\(%pid%\).*</line>
            </next>
      </pattern>
      <procmatch>
            <actionpair>
                  <line>.*monitored file opened name=\((.+)\)
pid=\((.+)\).*</line>
                  <action>
                        <highlight/>
                        <delete/>
                        <varop var="filename">%1%</varop>
                        <varop var="pidvar">%2%</varop>
                  </action>
            </actionpair>
      </procmatch>
      <annotation>
            <text>File Opened: %filename% (from pid: %pidvar%)</text>
      </annotation>
</regexp-query>
</doc>
```

Figure 34